REMARKS

Claims 1-19 are pending in this application, of which claim 17 has been amended. No new claims have been added.

Claims 1-15 stand rejected under 35 USC §102(e) as anticipated by U.S. Patent Appln. 2002/0119680 to Wang et al. (hereinafter "**Wang et al.**").

Applicants respectfully traverse this rejection.

Wang et al. discloses a method for the production of a semiconductor structure having self-organized quantum wires (holes). The process includes the formation of multi-atomic steps on a (001) oriented semiconductor substrate inclined at an angle toward the [110] direction. Quantum wires are then spontaneously formed in situ along edges of the multi-atomic steps during epitaxial growth of a semiconductor with a larger or smaller lattice constant than the substrate but with a band gap narrower than that of the underlying material. Further deposition of a layer of semiconductor with a lattice constant within 1% of the substrate but with a band gap wider than that of the wire material then buries the quantum wires between this layer and the substrate layers.

As set forth on page 8, lines 4-8 of the specification of the instant application, it is the object of the present invention to provide a quantum semiconductor device having a quantum dot formed by an S-K mode growth process, wherein the polarization dependence is eliminated.

It is noted that **Wang et al.** merely teaches a quantum wire array, not a quantum dot, in contrast to the present invention. In [0054] of **Wang et al.**, there is a description stating that "in

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which the active layer comprises a multi-layer quantum wire array as illustrated in FIG.4." This clearly indicates that the reference is related to <u>quantum wires</u>, not quantum dots.

Because carrier confinement takes place in <u>one dimension</u> in the case of quantum wires, quantum wires <u>do not</u> provide discrete quantum states, as in the case of quantum dots shown in FIG. 2 of the instant application.

It is therefore respectfully submitted that the quantum dots of the present invention are not an equivalent of the quantum well wires of **Wang et al.** Although **Wang et al.** refers to the quantum dot in the introductory part of the specification, this does not mean that the teaching of **Wang et al.** is applicable to a quantum semiconductor device having quantum dots, as in the present invention.

Wang et al. specifically fails to disclose at least the following present features of the claimed invention:

①   "each of said quantum dots having a height substantially identical with the thickness of said second barrier layer," as recited in claims 1 and 14;

②   "said third barrier layer making a contact with an apex of said quantum dot formed in said second barrier layer," as recited in claim 1 (and a similar limitation in claim 14); and

③   "wherein said first barrier layer has a composition modified in the vicinity of said quantum dot, and wherein said third barrier layer has a composition modified in the vicinity of said quantum dot," as recited in claim 2.

Thus, the 35 USC §102(e) rejection should be withdrawn.

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Claims 16-19 stand rejected under 35 USC §103(a) as unpatentable over **Wang et al.**

Applicants respectfully disagree.

The Examiner has admitted that **Wang et al.** fails to disclose the composition ratio of

InGaAsP recited in claim 16, but the Examiner has argued that such would be within the general skill

of a worker in the art.

Applicants respectfully disagree. Page 17, line 36 to page 18, line 21 disclose:

> FIG.9 shows the result of calculation of the transition energy Eg (see
> FIG.2) for the quantum dot 33 as measured from the fundamental
> state thereof, wherein the calculation is conducted on the structure of
> FIG.8 for the case the quantum dots 33 are formed of InAs and the
> barrier layer 32 has a lattice-matching composition of
> $In_{0.717}Ga_{0.283}As_{0.611}P_{0.389}$, while changing the composition of the barrier
> layer 34, represented by $In_xGa_{1-x}As_yP_{1-y}$, in the range of 0.15 x 0.92
> and 0.5 y 1. Thereby, it should be noted that the As-composition y is
> changed with the In-composition x such that the bandgap of the
> InGaAsP barrier layer 34 is maintained larger than the bandgap of the
> InAs quantum dot 33. Further, it should be noted that the calculation
> of FIG.9 has been conducted by approximating the InAs quantum dot
> 33 by a rectangular body having a size of 35nm x 35nm x 10nm. In
> this structure, the strain components ε_{xx} and ε_{yy} of the quantum dot 33
> have the value of -0.0067 (ε_{xx} and ε_{yy} =-0.0067). It should be noted
> that the negative value for the strain components ε_{xx} and ε_{yy} indicates
> that the quantum dot 33 accumulates therein a compressive in-plane
> strain.

It is only through hindsight with the disclosure of the present invention that one of ordinary skill in the art could arrive at the optimum composition ratio for InGaAsP without undue experimentation. The above discussion is not present in **Wang et al.**

Wang et al. fails to teach that "the predetermined stack number is set such that a proportion of interaction of said quantum dots to optimize radiation of TM-mode is equal to or larger than a proportion of interaction of said quantum dots to optimal radiation of TE-mode," as recited in claim 17 of the instant application.

Thus, the 35 USC §103(a) rejection should be withdrawn.

In view of the aforementioned amendments and accompanying remarks, claims 1-19, as amended, are in condition for allowance, which action, at an early date, is requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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Enclosures: Substitute Abstract of the Disclosure

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